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(54) COLOR CATHODE RAY TUBE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a high quality flat face color cathode ray tube with a tint panel combined with a press mask.

SOLUTION: The outer face of a panel of the color cathode ray tube is formed approximately flat and the inner face is curved into recessed face. The longitudinal pitch of slots formed in a perforated region 2 of the press mask 1 arranged in proximity to the inner face and the connection width of bridges connecting the slots are differentiated at a central portion (A) of the perforated region 2 of the press mask 1 from those at a peripheral portion (B). The percentage of the bridges occupied per unit area is larger at the central portion (A) than at the peripheral portion (B), or the percentage of the slots opened per unit area is larger at the peripheral portion (B) than at the central portion (A). Thus, the mechanical strength of the press mask is greater at the central portion (A), inhibiting the undesired deformation of the press mask 1 due to a so-called doming phenomenon resulting from the application of external impulse or temperature rise with the increase of the radius of curvature of the central portion (A) and permitting the uniform brightness all over the screen.

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CLAIMS

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[Claim(s)]

[Claim 1] The panel which has the inside which curved so that equivalence radius of curvature might serve as smallness from external surface, and formed the phosphor screen in this inside in the abbreviation rectangle configuration which consists of a long side and a shorter side, A vacuum envelope is constituted from a neck which held the electron gun, and a funnel which connects [ panel / above-mentioned ] the above-mentioned neck. It is the color cathode-ray tube which has arranged the press mask which has the perforated field in which the slot of a large number which connected the longitudinal direction on the bridge while having the curvature which curved so that the inside of the above-mentioned panel might be approached and it might become a convex at the above-mentioned phosphor-screen side was formed. When the effective diameter of the direction of a vertical angle of  $R_d$  (mm) and this phosphor screen is set to  $V$  (inch) for the equivalence radius of curvature of the

direction of a vertical angle of the above-mentioned panel external surface in the service area of the above-mentioned phosphor screen, The color cathode-ray tube which it is  $Rd \geq 10$  ( $42.5V + 45.0$ ), and the light transmittance of the above-mentioned panel is 60% or less, and is characterized by the rate of a throat area ratio per unit area of the slot of the above-mentioned press mask being larger than the center of the above-mentioned perforated field at the direction edge of a vertical angle.

[Claim 2] The color cathode-ray tube according to claim 1 characterized by being  $P1 < P2$  when the connection direction pitch of the slot in P1 and the direction edge of a vertical angle is set to P2 for the connection direction pitch of the slot in the center in the perforated field of the above-mentioned press mask.

[Claim 3] The color cathode-ray tube according to claim 1 characterized by being  $P1 < P2$  and  $B1 > B-2$  when the connection direction pitch of the slot in P1 and the direction edge of a vertical angle is set to P2 for the connection direction pitch of the slot in the center in the perforated field of the above-mentioned press mask and width of face between connection slots of the bridge in B1 and the direction edge of a vertical angle is made into B-2 for the width of face between connection slots of the bridge in the center of the above.

[Claim 4] The color cathode-ray tube according to claim 1 characterized by being  $B1 > B-2$  when width of face between connection slots of the bridge in B1 and the direction edge of a vertical angle is made into B-2 for the width of face between connection slots of the bridge in the center in the perforated field of the above-mentioned press mask.

[Claim 5] The color cathode-ray tube according to claim 1 characterized by the light transmittance of the above-mentioned panel being 50% or less.

[Claim 6] The panel which has the inside which curved so that equivalence radius of curvature might serve as smallness from external surface, and formed the phosphor screen in this inside in the abbreviation rectangle configuration which consists of a long side and a shorter side, A vacuum envelope is constituted from a neck which held the electron gun, and a funnel which connects [ panel / above-mentioned ] the above-mentioned neck. It is the color cathode-ray tube which has arranged the press mask which has the perforated field in which the slot of a large number which connected the longitudinal direction on the bridge while having the curvature which curved so that the inside of the above-mentioned panel might be approached and it might become a convex at the above-mentioned phosphor-screen side was formed. When the effective diameter of the direction of a vertical angle of  $Rd$  (mm) and this phosphor screen is set to V (inch) for the equivalence radius of curvature of the direction of a vertical angle of the above-mentioned panel external surface in the service area of the above-mentioned phosphor screen, When it is  $Rd \geq 10$  ( $42.5V + 45.0$ ) and  $Td$  and the central direction thickness of a tube axis are set to  $Tc$  for the direction thickness of a tube axis of the direction edge of a vertical angle of the above-mentioned panel in

the service area of the above-mentioned phosphor screen, (Td-Tc) Color cathode-ray tube which is  $/Tc \leq 0.8$  and is characterized by the ratio per unit area of the bridge of the above-mentioned press mask being larger than the direction edge of a vertical angle of the above-mentioned perforated field in the center.

[Claim 7] The color cathode-ray tube according to claim 6 characterized by being  $P1 < P2$  when the connection direction pitch of the slot in P1 and the direction edge of a vertical angle is set to P2 for the connection direction pitch of the slot in the center in the perforated field of the above-mentioned press mask.

[Claim 8] The color cathode-ray tube according to claim 6 characterized by being  $P1 < P2$  and  $B1 > B_2$  when the connection direction pitch of the slot in P1 and the direction edge of a vertical angle is set to P2 for the connection direction pitch of the slot in the center in the perforated field of the above-mentioned press mask and width of face between connection slots of the bridge in B1 and the direction edge of a vertical angle is made into  $B_2$  for the width of face between connection slots of the bridge in the center of the above.

[Claim 9] The color cathode-ray tube according to claim 6 characterized by being  $B1 > B_2$  when width of face between connection slots of the bridge in B1 and the direction edge of a vertical angle is made into  $B_2$  for the width of face between connection slots of the bridge in the center in the perforated field of the above-mentioned press mask.

[Claim 10] The color cathode-ray tube according to claim 6 characterized by being  $Td-Tc \leq 12\text{mm}$ .

[Claim 11] The color cathode-ray tube according to claim 6 characterized by the light transmittance of the above-mentioned panel being 60% or less.

[Claim 12] (Td-Tc) Color cathode-ray tube according to claim 6 characterized by being  $/Tc \leq 0.7\text{mm}$ .

[Claim 13] The color cathode-ray tube according to claim 12 characterized by being  $Td-Tc \leq 10\text{mm}$ .

[Claim 14] The color cathode-ray tube according to claim 12 characterized by the light transmittance of the above-mentioned panel being 50% or less.

[Claim 15] The color cathode-ray tube according to claim 6 characterized by the effective diameter of the direction of a vertical angle of the above-mentioned phosphor screen being 76cm or more.

[Claim 16] The panel which has the inside which curved so that equivalence radius of curvature might serve as smallness from external surface, and formed the phosphor screen in this inside in the abbreviation rectangle configuration which consists of a long side and a shorter side, A vacuum envelope is constituted from a neck which held the electron gun, and a funnel which connects [ panel / above-mentioned ] the above-mentioned neck. It is the color cathode-ray tube which has arranged the press mask which has the perforated field in which the slot of a large number which

connected the longitudinal direction on the bridge while having the curvature which curved so that the inside of the above-mentioned panel might be approached and it might become a convex at the above-mentioned phosphor-screen side was formed. When the effective diameter of the direction of a vertical angle of  $R_d$  (mm) and this phosphor screen is set to  $V$  (inch) for the equivalence radius of curvature of the direction of a vertical angle of the above-mentioned panel external surface in the service area of the above-mentioned phosphor screen, Are  $R_d \geq 10 (42.5V + 45.0)$  and the rate of a throat area ratio per unit area of the slot of the above-mentioned press mask is larger than the center of the above-mentioned perforated field at the direction edge of a vertical angle. The color cathode-ray tube characterized by the ratio per unit area of the bridge of the above-mentioned press mask being larger than the direction edge of a vertical angle of the above-mentioned perforated field in the center.

[Claim 17] The color cathode-ray tube according to claim 16 characterized by being [ in the connection direction pitch of the slot in the center in the perforated field of the above-mentioned press mask ]  $P_1 < P_2$  at the time of  $P_2$  and \*\* about the connection direction pitch of the slot in  $P_1$  and the direction edge of a vertical angle.

[Claim 18] The color cathode-ray tube according to claim 16 characterized by being  $P_1 < P_2$  and  $B_1 > B_2$  when the connection direction pitch of the slot in  $P_1$  and the direction edge of a vertical angle is set to  $P_2$  for the connection direction pitch of the slot in the center in the perforated field of the above-mentioned press mask and width of face between connection slots of the bridge in  $B_1$  and the direction edge of a vertical angle is made into  $B_2$  for the width of face between connection slots of the bridge in the center of the above.

[Claim 19] The color cathode-ray tube according to claim 16 characterized by being  $B_1 > B_2$  when width of face between connection slots of the bridge in  $B_1$  and the direction edge of a vertical angle is made into  $B_2$  for the width of face between connection slots of the bridge in the center in the perforated field of the above-mentioned press mask.

[Claim 20] The color cathode-ray tube according to claim 16 characterized by the effective diameter of the direction of a vertical angle of the above-mentioned phosphor screen being 76cm or more.

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#### DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the color cathode-ray tube which was

applied to the color cathode-ray tube, especially possesses the shadow mask corresponding to the flat face of a big screen.

[0002]

[Description of the Prior Art] As for the color cathode-ray tube widely adopted as a display device of an information terminal or a television set, the screen size tends to serve as size. Furthermore, the so-called flat face mold which carried out flattening of the panel section which forms a screen has spread.

[0003] The color cathode-ray tube which is carrying out current spread is made to approach the inside of the panel in which the fluorescent substance pixel of three colors was formed, has installed the colour selection electrode, and it is constituted so that three electron beams by which outgoing radiation was carried out from the electron gun may be made the bombardment [ with a colour selection electrode ] according to an individual to each fluorescent substance pixel.

[0004] As a colour selection electrode, carried out press forming of the sheet metal member which carried out punching formation of many holes (electron beam passage hole), such as a round hole (dot hole) or a thin long hole (slot), to the configuration where the curvature of a panel section inside was imitated, and incurvated it. The tension mask which \*\*\*\*(ed) what is called the so-called press mask, and the sheet metal member in which many holes were formed, to frame material (frame), or the thing called the aperture grille which \*\*\*\*(ed) thin \*\* of a large number which arranged in the shape of a blind between the opposite sides of frame material is used. In addition, the above-mentioned press mask and especially a tension mask are also called a shadow mask.

[0005] This kind of color cathode-ray tube unifies a funnel [ the panel which constitutes a phosphor screen, the neck which holds an electron gun, and a panel and a neck are connected / funnel ]-like funnel, and forms the vacuum envelope.

[0006] In addition, as a thing about the structure of a perforated field where the electron beam passage hole of a shadow mask has been arranged, JP,9-82234,A etc. is mentioned, for example.

[0007]

[Problem(s) to be Solved by the Invention] The panel section of the color cathode-ray tube of a flat face mold has thick glass thickness compared with the panel section of the color cathode-ray tube of a round face mold in order to secure mechanical strengths, such as implosion-proof, while it is bringing the inside-and-outside front face close evenly. As a shadow mask installed in such a flat face mold cathode-ray tube, the above-mentioned tension mask is common.

[0008] Moreover, in addition to this, as the panel section of the color cathode-ray tube of a flat face mold, while bringing the outside surface close evenly, the internal surface is incurvated so that glass thickness may become more nearly heavy-gage than a center section at a periphery and it may be on the above-mentioned outside-surface side with

concave. As a shadow mask installed in such a flat face mold cathode-ray tube, many press masks by which press forming was carried out are adopted as the curve of a panel section internal surface by the \*\*\*\*\* configuration.

[0009] the tint to which the panel which constitutes the vacuum envelope of a color cathode-ray tube fits high contrast image display -- many panels (tint panel) using the ground are used. In the commercial scene of current and the panel for cathode-ray tubes, this tint panel is in use, and it is comparatively cheap also in respect of cost, and easy to supply. moreover, a tint panel is clear -- the ground and gray -- since light transmittance is low compared with the panel (a clear panel and gray panel) using the ground, the contrast of the image in a cathode-ray tube is excellent.

[0010] In the case of the panel which enlarged radius of curvature extremely by the outside surface rather than the internal surface, and brought the outside surface close to a flat on the other hand, the thickness of a panel is quite thicker than a center section at a periphery, and whenever [ light transmission / of the periphery ] (the amount of transparency) is quite lower than that of a center section. If a tint panel with light transmittance low on the whole is applied to the panel put close to the above-mentioned flat, especially, the fall of whenever [ light transmission / of a periphery ] will be conspicuous, and the homogeneity of the brightness in the screen whole region of a cathode-ray tube will be spoiled.

[0011] Therefore, if [ the electron beam through put of a colour selection electrode is the same in the whole region ] the amount of luminescence of a fluorescent substance is the same throughout a panel (i.e., if), it becomes that to which the brightness of a periphery fell. The difference of whenever [ this light transmission ] can be amended by changing the amount of electron beam transparency of a colour selection electrode.

[0012] Moreover, by the thing especially with the large screen size, the tension mask and aperture grille to which deformation by the thermal expansion at the time of the electron beam collision of a colour selection electrode cannot take place easily are suitable with the color cathode-ray tube of the flat face mold using the panel which brought the inside-and-outside front face close evenly.

[0013] However, since they require the proper tension grant activity in consideration of material strength, the amount of relaxation by the temperature change, etc. in case a tension mask and an aperture grille \*\*\*\* a colour selection electrode on the frame, and the firm structure is mechanically needed as a frame, a manufacturing cost is size.

[0014] On the other hand, since a press mask is what carries out press forming and is manufactured to the curve of the inside of a panel at a \*\*\*\*\* configuration, manufacture of itself is easy. On the other hand, extent of the curve of the center section of a panel inside of a curve of the center section decreases, so that the diagonal length of size, for example, a screen service area, becomes [ panel size ] as large as 76cm or more (radius of curvature becomes size). Moreover, when applying this press mask to the panel which brought the outside surface close to a flat, in order to improve the

homogeneity of the brightness in the screen whole region of a cathode-ray tube, it is necessary to make small the thick difference of a panel center section and a periphery as much as possible. That is, it is necessary to make extent of a curve of a panel inside and a press mask as small as possible, and to carry out the radius of curvature of a panel inside and a press mask to beyond a predetermined value. Generally, with the press mask constituted from sheet metal, configuration maintenance capacity is size, so that extent of the curve is large, such mechanical reinforcement falls and configuration maintenance capacity becomes small that extent of a curve is conversely small.

[0015] especially , it be a production process and an external impact on the way of transportation , or it originate in working heating and a form status change form occur , if a press mask be overly use for the color cathode-ray tube of a flat face mold with a large-sized screen size , the press mask reinforcement of the center section where a radius of curvature be large will become small , the mechanical strength ( curved surface configuration maintenance capacity ) tend to fall , and there be [ above extent which bring about the fall of color reproduction nature be large , and ] a possibility may cause deterioration of image quality .

[0016] A curve with this kind of press mask makes it as smallness in the center section, makes it size by the periphery, makes it crooked in the direction parallel to the tube axis of a color cathode-ray tube in a circumference maximum outline, and is fixed to frame material.

[0017] The range of the above-mentioned center section exists in the abbreviation 1 for the center of the direction of a major axis of the perforated field whose radius of curvature of a press mask is a field containing the becoming part size most / about three to 2/3 width of face. Therefore, although a periphery can gain a mechanical strength required for configuration maintenance, in the center section, it is difficult to obtain sufficient reinforcement concerned.

[0018] Since it was such, when a press mask was used for the color cathode-ray tube of the flat face mold using a tint panel, it had become a technical problem to secure the mechanical strength of the center section.

[0019] The purpose of this invention solves the technical problem of the above-mentioned conventional technique, and is to realize the color cathode-ray tube of the flat face mold of high quality combining a press mask on a tint panel. And especially this invention is to solve the large size which used the tint panel, and the problem peculiar to the above-mentioned press mask overly in the color cathode-ray tube of the flat face mold of large-sized size, and obtain a shadow mask with large deformation-proof reinforcement.

[0020]

[Means for Solving the Problem] The longitudinal direction pitch of the slot formed in the press mask which this invention makes an abbreviation flat the external surface of the panel of a color cathode-ray tube, an inside is incurvated so that it may become

concave at the external surface side concerned, and approaches the inside, and is arranged in order to attain the above-mentioned purpose. At least one side of the connection direction width of face of the bridge which connects this slot with a longitudinal direction by making it differ by the center section and periphery of a perforated field of the press mask concerned. The ratio of the bridge per unit area was made into size in the center section from the periphery, or the slot puncturing ratio per unit area was made into size by the periphery from the center section.

[0021] By this, the mechanical strength of the center section of the press mask becomes large, and generating of the deformation [ \*\*\*\* / un- ] from which spacing between the panel insides of a center section changes by the so-called doming phenomenon resulting from the impression and the temperature rise of an external impact by having enlarged the radius of curvature of a center section can be controlled, and equalization of the brightness in the screen whole region is attained.

[0022] The above-mentioned center section can be made into the central abbreviation 1 for the direction of a major axis of a panel / about three to 2/3 range, the central abbreviation 1 for the direction of a minor axis / about three to 2/3 range, or such combination. Furthermore, the pars intermedia (transition section) which has the connection direction width of face of the bridge which connects this slot with the longitudinal direction pitch of the slot both middle value can be prepared between the above-mentioned center section and a periphery. Moreover, at least by one side of the above-mentioned center section and a periphery, the above-mentioned slot pitch and bridge width of face can also be gradually changed as it separates from the center of a perforated field. With such a configuration, the abrupt change of the slot pitch concerned and bridge width of face can be controlled, and mechanical reinforcement can be smoothly changed from a periphery to a center section.

[0023] Consequently, also with the color cathode-ray tube of a super-\*\* type flat face mold with which the diagonal size of an effective viewing area exceeds 76cm, the combination of a tint panel and a press mask becomes possible, and low cost and the color cathode-ray tube of high quality can be realized.

[0024] In addition, even if it does not overly restrict to the color cathode-ray tube of a flat face mold with a large-sized screen size and is [ a large size and ] the color cathode-ray tube of a flat face mold in a small screen size comparatively, this invention can be similarly applied, when using a board ultra-thin as the press mask.

[0025]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail with reference to the drawing of an example.

[0026] Drawing 1 is the top view of the press mask explaining the 1st example of the color cathode-ray tube by this invention, and explains typically the arrangement field of a center section and the periphery of a press mask which approaches the panel inside of a color cathode-ray tube, and is arranged.

[0027] Moreover, drawing 2 is an important section top view which explains typically the bridge which connects each slot and slot of a center section and a periphery in drawing 1 with a longitudinal direction.

[0028] In drawing 1, the press mask 1 has the perforated field 2 which forms a viewing area in nothing and its inside for the shape of an abbreviation rectangle which made the long side the longitudinal direction (as parallel as X-X-axis (major axis) of drawing 1), and used the lengthwise direction (as parallel as the Y-Y shaft (minor axis) of drawing 1) as the shorter side. The range which has the about 1/3 abbreviation [ for the center of a longitudinal direction of this perforated field 2 ] width of face W is a center section (A), and makes the periphery (B) those right-and-left both sides. The radius of curvature of a press mask of the range of the above-mentioned abbreviation 1/3 used as the center section (A) is a field containing the becoming part size most.

[0029] (a) of drawing 2 shows the longitudinal direction pitch of a slot, the longitudinal direction pitch of a slot [ in / for the connection direction width of face of a bridge / in \*\* (b) / the point of the arbitration of a periphery (B) ], and the connection direction width of face of a bridge. [ / near the central point O (intersection of X-X-axis and a Y-Y shaft) of the center section (A) of drawing 1 ] The slots SL1 and SL2 formed in a center section (A) and a periphery (B), respectively had the longitudinal direction in the direction parallel to the minor axis (Y-Y shaft) of the press mask 1, were connected with this longitudinal direction on bridges BR1 and BR2, respectively, and are arranged. In addition, the bridge which connects a slot with a longitudinal direction is a field between slots in the train of the slot of the lengthwise direction (as parallel as a Y-Y shaft (minor axis)) of a press mask perforation field. That is, a bridge is a field between slots in the width of face of the direction of a minor axis of a slot (direction which intersects perpendicularly with a longitudinal direction).

[0030] And the connection direction pitch of the slot [ in / for the connection direction pitch of the slot // near the central point O of a center section (A) / SL 1 / the point of the arbitration of P1 and a periphery (B) ] SL 2 is set to P2. When width of face between connection slots of the bridge BR 2 which connects between B1 and the slot SL 2 in the point of the arbitration of a periphery (B) for the width of face between connection slots of the bridge BR 1 which connects between the slots SL 1 near the central point O of a center section (A) was made into B-2, it considered as  $P1 < P2$  and  $B1 = B-2$ . In addition, the longitudinal direction array pitch (the above-mentioned connection direction pitch) of a slot is equivalent to the diameter of longitudinal direction opening of a slot, and the sum of connection slot spacing of the above-mentioned bridge.

[0031] By the configuration of this example, the area of the bridge per unit area of a center section (A) becomes larger than that of a periphery (B). Therefore, mechanical reinforcement of the center section (A) of the press mask can be made larger than that of a periphery (B), and even when radius of curvature becomes large, the curve

configuration can be held.

[0032] Consequently, deformation [ \*\*\*\* / the press mask by impression or the temperature rise of an external impact / un-] is controlled, the color sorting function stabilized even if it combined the press mask with the panel of a flat face mold is demonstrated, and it becomes possible to control generating of a color gap of a color cathode-ray tube or an irregular color. Furthermore, the brightness of a periphery can be raised because the numerical aperture of the slot SL 2 in a periphery (B) becomes higher than that of a center section (A). And when the tint panel suitable for high contrast image display is used, the low permeability of a periphery is amended, the image display of the high brightness in the whole screen becomes possible, and the color cathode-ray tube which can display the image of high quality can be offered.

[0033] In this example, it considered as the range which has about 1/3 abbreviation [ for the center of a longitudinal direction of the perforated field 2 whose radius of curvature of a press mask is a field containing the becoming part size most about the center section (A) ] width of face. However, the range of this center section (A) does so the effectiveness containing about 1/3 above-mentioned abbreviation width of face same also as width of face that radius of curvature is about 2/3 abbreviation for the center of a longitudinal direction of the perforated field 2 which is a becoming field size, comparatively.

[0034] It will be as follows if the concrete numerical example of this example is described. Each die length along the major axis in the dimension of the press mask 1 using the iron system material whose board thickness is 0.25mm, and a minor axis, respectively About 735mm, When 562mm and diagonal length are about 870mm, the connection direction pitch P1 of the slot SL 1 near the central point O of a center section (A)  $0.84**0.005$ mm, The connection direction pitch P2 of the slot SL 2 near the corner of a periphery (B)  $1.40**0.005$ mm, Both width-of-face B-2s between connection slots of the bridge BR 2 which connects between the slots SL 2 in the width of face B1 between connection slots and the periphery (B) of the bridge BR 1 which connects between the slots SL 1 in a center section (A) are  $0.1500**0.005$ mm. In addition, the connection direction pitch of the above-mentioned slot is a numerical example in the shadow mask used for the general-purpose color cathode-ray tube for television sets. For example, in the shadow mask used for Hi-Vision and the color cathode-ray tube for television sets for digital broadcasting, display density of an image is made high, using  $0.60**0.005$ mm and the connection direction pitch P2 of the slot SL 2 of a periphery (B) as  $0.84**0.005$ mm for the connection direction pitch P1 of the slot SL 1 of a center section (A).

[0035] Moreover, as for the ratios P2/P1 of the periphery (B) to the center section (A) of the connection direction pitch of a slot, 1.05-1.85 are desirable. When connection slot spacing of a bridge is the same at a center section (A) and a periphery (B), the effectiveness of the improvement in brightness in the screen periphery of the flat face

mold cathode-ray tube with which P2/P1 goes down 1.05 is small. On the other hand, if P2/P1 exceeds 1.85, the vertical definition of the display image in the screen periphery of a cathode-ray tube will deteriorate.

[0036] Moreover, although it is making the connection direction pitch of a slot each into one kind (a total of two kinds) by the center section (A) and the periphery (B) in the above-mentioned numerical example, the same effectiveness is done so even if the above P2/P1 makes it increase from the central point O gradually toward at least one direction of an apsis, a minor-axis edge, and a corner in the range which does not exceed 1.85. If an aspect ratio makes the above P2/P1 increase from the central point O gradually toward the direction of an apsis with a large deflection angle, or a corner in the color cathode-ray tube of the wide screen of the 16:9th grade especially at least, the brightness homogeneity in the screen whole region will improve effectively. Moreover, the same effectiveness is done so even if it makes P2/P1 increase the connection direction pitch of a slot gradually as mentioned above by the periphery (B).

[0037] Drawing 3 is the same important section top view as drawing 2 explaining the 2nd example of the color cathode-ray tube by this invention. In this example Between the connection direction pitch P1 of the slot SL 1 of a center section (A), the connection direction pitch P2 of the slot SL 2 of a periphery (B), the width of face B1 between connection slots of the bridge BR 1 which connects between the slots SL 1 in a center section (A), and the slot SL 2 in a periphery (B) Let relation of width-of-face B-2 between connection slots of the bridge BR 2 to connect be P1 <P2 and B1> B-2.

[0038] By the configuration of this example, the area of the bridge BR 1 per unit area of a center section (A) becomes still larger rather than that of a periphery (B) compared with the 1st example. Therefore, mechanical reinforcement of the center section (A) of the press mask can be made still larger than that of a periphery (B), and even when radius of curvature becomes large, the curve configuration can fully be held.

[0039] Consequently, it becomes possible to control deformation [ \*\*\*\* / a press mask / un-] like the 1st example, and to control a color gap and irregular color of a color cathode-ray tube. Moreover, compared with the 1st example, the brightness of a periphery can be further raised because the numerical aperture of the slot SL 2 in a periphery (B) becomes still higher from that of a center section (A). And even when a tint panel with low light transmittance is used, the low permeability of a periphery is amended efficiently, the image display of the high brightness in the whole screen becomes possible, and the color cathode-ray tube which can display the image of high quality can be offered. moreover -- since the brightness of the panel periphery of a cathode-ray tube improves effectively in the 2nd example -- a tint panel -- a dark tint with still lower light transmittance -- the panel (dark tint panel) using the ground is applicable. And the color cathode-ray tube which can display an image with still higher contrast can be offered.

[0040] Like the 1st example, even if this example also expands the range of a center

section (A) to about 2/3 width of face of the center of a longitudinal direction of the perforated field 2, it does the same effectiveness so.

[0041] The concrete numerical example of this example is as follows. Width-of-face B-2s between connection slots of the bridge BR 2 where the width of face B1 between connection slots of the bridge BR 1 which connects between the slots SL 1 in the central point O of the press mask 1 (X-X-axis and a Y-Y shaft an intersection or near [ its ]) connects between the slots SL 2 near 0.1500mm and the press mask 1 near the apsis near the corner are 0.1379mm and 0.1412mm respectively. Moreover, the width of face between connection slots of a bridge is decreasing gradually respectively toward the direction edge of a major axis, and a corner from the central point O. Other numerical examples are the same as that of the 1st example of the above.

[0042] Drawing 4 is the same important section top view as drawing 2 and drawing 3 explaining the 3rd example of the color cathode-ray tube by this invention. In this example Between the connection direction pitch P1 of the slot SL 1 of a center section (A), the connection direction pitch P2 of the slot SL 2 of a periphery (B), the width of face B1 between connection slots of the bridge BR 1 which connects between the slots SL 1 in a center section (A), and the slot SL 2 in a periphery (B) Let relation of width-of-face B-2 between connection slots of the bridge BR 2 to connect be  $P1=P2$  and  $B1>B2$ .

[0043] Also by the configuration of this example, the same operation as the 1st example and effectiveness are done so, and the color cathode-ray tube which can display the image of high quality can be offered. Moreover, in the 3rd example, since the longitudinal direction pitches of a slot are a center section and a periphery and are equal, degradation of the vertical definition of the display image in the screen periphery of a cathode-ray tube is mitigated. And the color cathode-ray tube which can display a high definition image can be offered.

[0044] This example also does so the effectiveness same also as about 2/3 abbreviation [ for the center of a longitudinal direction of the perforated field 2 ] width of face for the range of a center section (A) like the 1st and 2nd examples.

[0045] The concrete numerical example of this example is as follows. Both the connection direction pitch P1 of the slot SL 1 of a center section (A) and the connection direction pitch P2 of the slot SL 2 of a periphery (B) are 0.84mm. Other numerical examples are the same as that of the 2nd example of the above.

[0046] Drawing 5 is the top view of the press mask explaining the 4th example of the color cathode-ray tube by this invention, and is the same typical explanatory view as drawing 1.

[0047] In drawing 5, the range which has the about 1/3 abbreviation [ for the center of a lengthwise direction of the perforated field 2 of the press mask 1 ] width of face H is a center section (A), and makes the vertical both sides the periphery (B). The radius of curvature of a press mask of the range of the above-mentioned abbreviation 1/3 used as

the center section (A) is a field containing the becoming part size most.

[0048] The width of face between connection slots of the bridge which connects between slots with the connection direction pitch of the slot formed in this center section (A) and periphery (B) was formed by the same relation as any of the 1st example - the 3rd example which were explained by aforementioned drawing 2 - drawing 4 they are.

[0049] This example also does so the same operation as said each example, and effectiveness, and the color cathode-ray tube which can display the image of high quality can be offered.

[0050] moreover -- this example -- the range of a center section (A) -- the radius of curvature of a press mask -- most -- size -- not only about 1/3 abbreviation [ for the center of a lengthwise direction of the perforated field 2 which is a field containing a part ] width of face but this about 1/3 abbreviation width of face is included -- comparatively -- radius of curvature -- size -- the effectiveness same also as width of face which is about 2/3 abbreviation for the center of a lengthwise direction of the perforated field 2 which is a field is done so.

[0051] Drawing 6 is the top view of the press mask explaining the 5th example of the color cathode-ray tube by this invention, and is the same typical explanatory view as drawing 5.

[0052] In this example, the range which has the about 1/3 abbreviation [ for the center of a longitudinal direction of the perforated field 2 of the press mask 1 ] width of face W and the about 1/3 abbreviation [ for the center of a lengthwise direction ] width of face H is a center section (A), and makes the perimeter the periphery (B). The radius of curvature of a press mask of the range of each abbreviation 1/3 for the above-mentioned longitudinal direction and a lengthwise direction used as the center section (A) is a field containing the becoming part size most.

[0053] The width of face between connection slots of the bridge which connects between slots with the connection direction pitch of the slot formed in this center section (A) and periphery (B) was formed by the same relation as any of the 1st example - the 3rd example which were explained by aforementioned drawing 2 - drawing 4 they are.

[0054] This example also does so the same operation as said each example, and effectiveness, and the color cathode-ray tube which can display the image of high quality can be offered.

[0055] The radius of curvature of a press mask most the range of a center section (A) size also for this example moreover, not only in the range (WxH) surrounded by the about 1/3 abbreviation [ for the center of each of the longitudinal direction and lengthwise direction of the perforated field 2 ] width of face which is a field containing the becoming part The effectiveness same also as a field surrounded by one side of the center of each of the longitudinal direction and lengthwise direction of the perforated

field 2 containing this about 1/3 abbreviation [ each ] width of face whose radius of curvature is the becoming field size, or each about 2/3 abbreviation width of face is comparatively done so. Furthermore, the range of a center section (A) does so the effectiveness same also as circular [ which has the abbreviation 1 for the center of each of the longitudinal direction and lengthwise direction of the above-mentioned perforated field / about three to 2/3 diameter ], an ellipse, or an ellipse form.

[0056] Drawing 7 is the top view of the press mask explaining the 6th example of the color cathode-ray tube by this invention, and is the same typical explanatory view as drawing 5 and drawing 6.

[0057] In this example, the range which has the about 1/3 abbreviation [ for the center of the longitudinal direction of the perforated field 2 of the press mask 1 ] width of face W is a center section (A), and the field through the pars intermedia (C) of the right-and-left both sides is made into the periphery (B). The radius of curvature of a press mask of the range of the abbreviation 1/3 for the above-mentioned longitudinal direction used as the center section (A) is a field containing the becoming part size most.

[0058] The width of face between connection slots of the bridge which connects between slots with the connection direction pitch of the slot formed in this center section (A) and periphery (B) was formed by the same relation as any of the 1st example - the 3rd example which were explained by aforementioned drawing 2 - drawing 4 they are. And the connection direction width of face of the bridge which connects with a longitudinal direction the longitudinal direction pitch of a slot and slot which are formed in pars intermedia (C) is made into the middle pitch and the width of face of a value of a center section (A) and a periphery (B).

[0059] By this example, the area of the bridge BR 1 per unit area of a center section (A) becomes larger than that of a periphery (B). Therefore, mechanical reinforcement of the center section (A) of the press mask can be made larger than that of a periphery (B). Moreover, the mechanical reinforcement from a center section (A) to a periphery (B) can be gradually changed by making pars intermedia (C) intervene, and even when radius of curvature becomes large, the curve configuration can be held reasonable.

[0060] Consequently, while becoming possible to control deformation of a press mask like said each example, and to control a color gap and irregular color of a color cathode-ray tube, it can be made to improve so that the numerical aperture of the slot SL 2 in a periphery (B) may become high gradually and may become more uniform from it of a center section (A) about the brightness of a periphery. And even when a tint panel with low light transmittance is used, the low permeability of a periphery is amended, the image display of the high brightness in the whole screen becomes possible, and the color cathode-ray tube which can display the image of high quality can be offered.

[0061] Moreover, the same effectiveness is done so, even if this example also makes the range of a center section (A) not only about 1/3 abbreviation [ for the center of a longitudinal direction of the perforated field 2 whose radius of curvature of a press mask

is a field containing the becoming part size most ] width of face but about 2/3 abbreviation width of face and makes some pars intermedia (C) intervene between peripheries (B). The width of face of this pars intermedia (C) is suitably set up according to the size of a perforated area size, i.e., a press mask.

[0062] Drawing 8 is the top view of the press mask explaining the 7th example of the color cathode-ray tube by this invention, and is the same typical explanatory view as drawing 5 - drawing 7.

[0063] This example makes pars intermedia (C) intervene between the center section (A) in the 4th example of this invention explained by drawing 5, and a periphery (B), and the effectiveness becomes what combined the effectiveness of pars intermedia (C) of having explained by the 4th example and said drawing 7 concerned. The width of face of this pars intermedia (C) as well as the 6th example is suitably set up according to the size of a perforated area size, i.e., a press mask.

[0064] Also by this example, the same operation as said 6th example and effectiveness are done so, and the color cathode-ray tube which can display the image of high quality can be offered.

[0065] Drawing 9 is the top view of the press mask explaining the 8th example of the color cathode-ray tube by this invention, and is the same typical explanatory view as drawing 5 - drawing 8.

[0066] This example makes pars intermedia (C) intervene between the center section (A) in the 5th example of this invention explained by drawing 6, and a periphery (B), and the effectiveness becomes what combined the effectiveness of pars intermedia (C) of having explained by the 5th example and said drawing 7 concerned, and drawing 8. The width of face of this pars intermedia (C) as well as the 6th and 7th examples is suitably set up according to the size of a perforated area size, i.e., a press mask.

[0067] Also by this example, the same operation as said 6th and 7th examples and effectiveness are done so, and the color cathode-ray tube which can display the image of high quality can be offered.

[0068] Next, the whole color cathode-ray tube configuration using this press mask is explained to be the detail of the press mask used for the color cathode-ray tube of above-mentioned this invention.

[0069] Drawing 10 is a top view explaining the configuration of the pars intermedia material before plastic surgery of a press mask. This pars intermedia material 1' has formed many slots SL (SL1, SL2) in the perforated field 2 of the sheet metal of an iron system metal by etching processing. The slot SL 1 of a center section and the slot SL 2 of a periphery are arranged in the configuration where it explained depending on any of each aforementioned example they are.

[0070] In (a), drawing 11 is the explanatory view of the press mask assembly structure which carried out the press plastic surgery of the pars intermedia material shown in drawing 10 at the curve configuration, and was fixed to the mask frame, the top view

seen from the phosphor screen and the side which counters, and (b) show the shorter side side side elevation of (a), and (c) shows the long side side side elevation of (a).

[0071] The press mask 1 is crooked in the direction which is made into the configuration which curves by press working of sheet metal so that it may be on a phosphor-screen side with a convex to the perforated field, and is parallel to the tube axis of a color cathode-ray tube in a periphery, and is fabricated.

[0072] Welding immobilization of the suspension spring 4 for being welded to the wall of the mask frame 3 which is frame material, and equipping the outer wall of the corner section with the crooked periphery in the panel of a color cathode-ray tube is carried out. In addition, the concaves 4a and 4b for reinforcing the mechanical strength of the mask frame concerned are suitably given to the mask frame 3. In addition, the reinforcement means of the above-mentioned mechanical strength is not restricted to what was shown in drawing 11, and can apply a known reinforcement means.

[0073] drawing 12 -- drawing 11 -- having been shown -- a press -- a mask -- assembly -- a structure -- an important section -- structure -- an explanatory view -- it is -- (a) -- drawing 11 -- (a) -- it can set -- X -- ' - X -- " -- or -- Y -- ' - Y -- " -- having met -- a sectional view -- (b) -- drawing 11 -- a corner -- the section -- it can set -- a press -- a mask -- a mask -- a frame -- combination -- structure -- explaining -- a partial diagrammatic view -- it is .

[0074] In (a) of drawing 12, the press mask 1 is welded at the welding point which it was inserted in the wall of the mask frame 3, and was shown by x all over drawing. This welding point is in two or more places which go a mask frame around, and that mark and location are set up on condition that the size of a press mask assembly structure, the radius of curvature of a curve, and others.

[0075] In the corner section of a press mask assembly structure, it has wall surface 3a as shown in (b) of drawing 12, and the suspension spring 4 (refer to drawing 11) is welded to this wall surface 3a.

[0076] Thus, the assembled press mask assembly structure is approached and installed in the phosphor screen applied to the panel inside of a color cathode-ray tube. Installation of the press mask assembly structure to a panel is performed by making the suspension spring shown in the stud pin which stood erect in the side-attachment-wall inside of the panel concerned at drawing 11 engaged.

[0077] Drawing 13 is a sectional view which explains typically the whole color cathode-ray tube example of a configuration of this invention. This color cathode-ray tube has the vacuum envelope constituted from an abbreviation funnel [ the neck 8 which holds the electron gun 10 which carries out outgoing radiation of the panel 6 and three electron beam B which the screen becomes from abbreviation rectangle-like tint glass, and a panel 6 and a neck 8 are connected / funnel ]-like funnel 7.

[0078] The certified value of the light transmittance of the panel 6 which consists of the above-mentioned tint glass is 57%, and this is a value over the glass thickness of

10.16mm on the wavelength of 546nm. This tint panel is defined in the range of the \*\*2% of the above-mentioned certified values. If the panel of 60% or less of abbreviation is used as the above-mentioned light transmittance, the high contrast image in a color cathode-ray tube will be obtained. Moreover, the certified value of light transmittance is 46%, and the dark tint panel which fits high contrast image display further from the above-mentioned tint panel is defined in the range of \*\*2% of this certified value.

[0079] It is the so-called flat face type which has a flat side or very big radius of curvature, and is curving very slightly, the external surface, i.e., the screen, of a panel 6 which constitutes this vacuum envelope.

[0080] Drawing 14 is a fragmentary sectional view explaining the detail configuration of the direction of a vertical angle of a panel. When the external surface of a straight panel is an aspheric surface configuration, the radius of curvature changes with locations of the arbitration of panel external surface. Then, the curvature of this panel external surface can be defined as follows as equivalence radius of curvature  $R_d$  (mm).

[0081] The distance (mm) of the direction where  $R_d = (Zd^2 + Dd^2)/2Zd$ , however the tube axis from the center of panel external surface to a phosphor-screen service area edge and  $Dd$  cross at right angles, and  $Zd$  are the amounts of depression of the center of the panel external surface in the above-mentioned phosphor-screen service area edge to the direction of a tube axis (mm). In addition, even if it transposes the above-mentioned panel external surface to a panel inside or a shadow mask (press mask), it can be defined similarly. Moreover, even if it replaces the above-mentioned diagonal direction in the direction of a major axis, or the direction of an end axis, it can be defined similarly.

[0082] Depending on the size of the screen size of a cathode-ray tube, even if the radius of curvature of panel external surface is the same, the feeling of a flat differs. Then, the outside radius of curvature  $R_o$  (mm) and the inside radius of curvature  $R_i$  (mm) of a panel which were standardized regardless of the screen size as evaluation of this feeling of a flat are defined as follows respectively.

[0083]  $R_o = 42.5V + 45.0$  and  $R_i = 40.0V + 40.0$ , however  $V$  are the effective diameters (inch) of the direction of a vertical angle of a screen. And extent of flat \*\* of a panel can be expressed by the multiple of the outside radius of curvature  $R_o$  of the panel which carried out [ above-mentioned ] the standardization, or the inside radius of curvature  $R_i$ . In addition, the "inch" showing the above-mentioned effective diameter is vocabulary currently used idiomatically, in order to express the screen size of a cathode-ray tube, and it is a numeric value generally used like "OO inch mold cathode-ray tube."

[0084] In this invention, the screen is shown as the abbreviation flat by setting the equivalence radius of curvature of panel external surface to 10 or more  $R_o$ s. moreover -- said -- when  $20R_o$ (es), a screen is visible to an almost perfect flat.

[0085] Moreover, in order to use the press mask 1 which incurvated the perforated field

to convex as a shadow mask, it cannot consider as a flat face type like [ inside / of a panel 6 ] the above-mentioned external surface, but is made to curve with fairly bigger curvature than this external surface in this invention. And the inside has a curved surface so that the direction thickness  $T_d$  of a tube axis of the usual picture area corner (the direction edge of a vertical angle) of a panel 6 may become fairly more nearly heavy-gage than central direction of tube axis thick  $T_c$ , and it serves as concave at the external surface side.

[0086] thick difference  $T_d-T_c$  [ in / in order to reconcile the improvement in contrast of the brightness unevenness reduction in the middle of the screen and the circumference of a cathode-ray tube and an image / a panel usual picture area corner (the direction edge of a vertical angle), and a center ] (the amount  $W_d$  of direction wedges of a vertical angle) -- as much as possible -- small -- carrying out -- glass with light transmittance low as much as possible -- it is desirable to use the ground.

[0087] this invention -- the ratio of the above-mentioned amount  $W_d$  of direction wedges of a vertical angle, and panel central thick  $T_c$  -- light transmittance can apply 60% or less of tint panel by making  $W_d/T_c$  or less into 0.8. Moreover, light transmittance can apply 50% or less of dark tint panel by making above-mentioned ratio  $W_d/T_c$  or less into 0.7. When using a tint panel and using 12mm or less and a dark tint panel as the above-mentioned amount  $W_d$  of direction wedges of a vertical angle, 10mm or less is desirable. And as equivalence radius of curvature of the inside of the panel 6 at this time, 6000mm or more is desirable in the direction of a vertical angle.

[0088] Since the curved surface of the perforated field of the press mask 1 makes electron beam B land to a phosphor screen 13 easily, it is [ being formed so that the inside of a panel 6 may be imitated if possible ] desirable.

[0089] In this invention, the equivalence radius of curvature of the press mask 1 is set to 4000mm or more in the direction of a vertical angle of a perforated field. This is quite big radius of curvature compared with the press mask of the color cathode-ray tube of the conventional round face mold, and is a direction to which the mechanical strength of a press mask center section falls. However, the problem of a mechanical strength is coped with by adopting which press mask of each example by above-mentioned this invention.

[0090] The phosphor screen 13 which applied the fluorescent substance pixel of three colors in the predetermined array is formed in the inside of a panel 6.

[0091] The press mask assembly structure 30 which welded the press mask 1 to the mask frame 3 makes the suspension spring 4 welded to the corner section engage with the stud pin 9 which stood erect in the side-attachment-wall inside of a panel 6, and is attached. Moreover, the magnetic shielding 5 for covering electron beam B from external magnetic fields, such as earth magnetism, is attached in the electron gun side of this press mask assembly structure 30.

[0092] The deflecting yoke 11 for deflecting three electron beam B which carried out

outgoing radiation from an electron gun 10 to a horizontal direction (the direction of X-X, longitudinal direction) and a perpendicular direction (the direction of Y-Y, lengthwise direction) is constructed across the neck 8 side of a funnel 7. The periphery of a neck 8 is equipped with the auxiliary magnetic device 12 for acting in spacing of an electron beam, a mutual location, and the direction of a course, and amending color purity and a beam convergence gap (mistake convergence).

[0093] A picture signal is supplied to an electron gun 8 from the external circuit which is not illustrated. Modulating three electron beams with this picture signal, outgoing radiation of the modulated electron beam B is carried out in the phosphor-screen 13 direction, it is deflected by the level field and perpendicular field which are generated with a deflecting yoke on that way, and reproduces a two-dimensional image on a phosphor screen 13.

[0094] The color cathode-ray tube of above-mentioned this invention can display the image of the high quality which it was hard to generate deformation on the press mask concerned under impression of an external impact, or the effect of operating temperature, therefore reduced generating of a color gap or an irregular color remarkably by having had the press mask explained depending on any of each of said example they are.

[0095] In addition, it cannot be overemphasized that various deformation is possible, without deviating from the technical thought of this invention which this invention is not limited to the above-mentioned example, and was described to the claim.

[0096]

[Effect of the Invention] According to this invention, as explained above, since deformation of the shadow mask as a colour selection electrode is controlled, and since the electron beam transmission efficiency of the periphery of a perforated field can be improved, it is overly large-sized and low cost can realize a large size and the color cathode-ray tube of the high quality which the combination of a tint panel and a press mask of becomes possible, and has neither a color gap nor an irregular color also at the color cathode-ray tube of a flat face mold.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the top view of the press mask explaining the 1st example of the color cathode-ray tube by this invention.

[Drawing 2] It is the important section top view which explains typically each slot and bridge of a center section and a periphery in drawing 1.

[Drawing 3] It is the same important section top view as drawing 2 explaining the 2nd

example of the color cathode-ray tube by this invention.

[Drawing 4] It is the same important section top view as drawing 2 and drawing 3 explaining the 3rd example of the color cathode-ray tube by this invention.

[Drawing 5] It is the top view of the press mask explaining the 4th example of the color cathode-ray tube by this invention.

[Drawing 6] It is the top view of the press mask explaining the 5th example of the color cathode-ray tube by this invention.

[Drawing 7] It is the top view of the press mask explaining the 6th example of the color cathode-ray tube by this invention.

[Drawing 8] It is the top view of the press mask explaining the 7th example of the color cathode-ray tube by this invention.

[Drawing 9] It is the top view of the press mask explaining the 8th example of the color cathode-ray tube by this invention.

[Drawing 10] It is a top view explaining the configuration of the pars intermedia material which carried out punching before plastic surgery of a press mask.

[Drawing 11] It is the explanatory view of the press mask assembly structure which carried out the press plastic surgery of the pars intermedia material shown in drawing 10 at the curve configuration, and was fixed to the mask frame.

[Drawing 12] It is the explanatory view of the important section structure of the press mask assembly structure shown in drawing 11.

[Drawing 13] It is the sectional view which explains typically the whole color cathode-ray tube example of a configuration of this invention.

[Drawing 14] It is a fragmentary sectional view explaining the detail configuration of a panel.

#### [Description of Notations]

1 Press Mask

1' Pars intermedia material of a press mask

2 Perforated Field

3 Mask Frame

4 Suspension Spring

5 Magnetic Shielding

6 Panel

7 Funnel

8 Neck

9 Stud Pin

10 Electron Gun

11 Deflecting Yoke

12 Auxiliary Magnetic Device

13 Phosphor Screen

30 Press mask assembly structure.

SL (SL1, SL2) Slot

BR (BR1, BR2) Bridge

P1, P2 Slot pitch

BR1, BR2 Width of face between connection slots of a bridge.